LAKE STATES ASPEN REPORT NO. 17

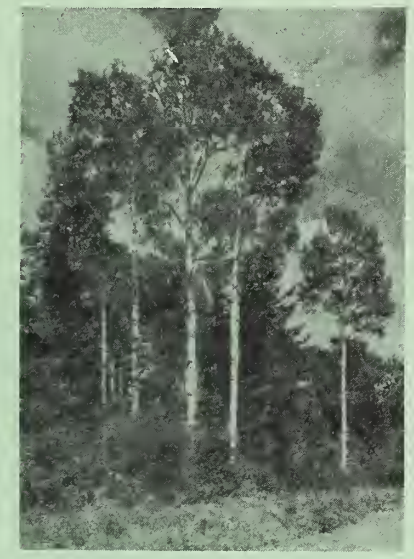
ASPEN DEFIBERIZATION AND REFINING OF PRODUCT

BY

ROBERT CRAIG JR.

SCHOOL OF FORESTRY AND CONSERVATION

UNIVERSITY OF MICHIGAN



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FOREWORD

During and since World War II, there has been increasing interest in aspen (*Populus tremuloides*) in the Lake States, its availability and supply, properties and uses, and management. Aspen is a tree of primary importance in 20 million acres or 40 percent of the total forest area of the three Lake States - Michigan, Minnesota, and Wisconsin.

At an informal meeting at Madison, Wisconsin, in January, 1947, forestry representatives of several federal, state, and industrial groups in the Lake States agreed that it would be desirable to bring up to date what is known on aspen and make it available to anyone interested. The job of preparing this information in the form of reports was assigned to each of the groups listed below. The reports will be duplicated as rapidly as completed, and the entire project should be finished by the end of 1947. Each report will concern one aspect of the subject. Copies will be available from the Lake States Forest Experiment Station or from each contributor.

Report Number	Subject
1	Aspen Properties and Uses
2	Aspen Availability and Supply
3	Logging Methods and Peeling of Aspen
4	Milling of Aspen into Lumber
5	Seasoning of Aspen
6	Aspen Lumber Grades and Characteristics
7	Mechanical Properties of Aspen
8	Machining and Related Properties of Aspen
9	Aspen Lumber for Building Purposes
10	Aspen for Containers
11	Aspen for Core Stock
12	Small Dimension and Other Industrial Uses of Aspen
13	Aspen for Veneer
14	Aspen for Pulp and Paper
15	Aspen for Cabin Logs
16	Aspen for Excelsior
17	Aspen Defiberization and Refining of Product
18	Chemical Utilization of Aspen
19	Preservative Treatment of Aspen
20	Marketing of Aspen
21	Possibilities of Managing Aspen

Contributors to Lake States Aspen Reports

Lake States Forest Experiment Station, St. Paul 1, Minn.
Forest Products Laboratory, Madison 5, Wis.
North Central Region, U. S. Forest Service, Milwaukee 3, Wis.
Div. of Forestry, Univ. of Minnesota, University Farm, St. Paul 1, Minn.
School of Forestry and Conservation, University of Michigan, Ann Arbor, Mich.
Department of Forestry, Michigan State College, East Lansing, Mich.
Michigan College of Mining and Technology, Houghton, Mich.
Superior Wood Products, Inc., Duluth 2, Minn.
Forestry Agent, Chicago & North Western Railway System, St. Paul 1, Minn.

REPORT NO. 17

ASPEN "DEFIBERIZATION" AND REFINING OF PRODUCT

By

Robert Craig, Jr., Associate Professor of Forest Utilization
School of Forestry and Conservation
University of Michigan, Ann Arbor, Michigan

Because of the great demand for wood fiber and because there is an abundance of aspen available[1/] for this purpose, its conversion into a usable fiberized material offers possibilities. It also affords an outlet for low-quality bolts developed in any aspen logging operation or from land of poor quality.

Allis-Chalmers Defiberizer

The "defiberization" of wood waste or of little-used wood species offers one means of obtaining high yields of fibrous material at a relatively low cost. At present the chief users of fiberized aspen are the roofing manufacturers. The felt made in a few mills for this purpose contains an appreciable quantity of this fiber and it has been found to absorb the asphalt in a satisfactory manner.

The shredded type of fiber produced by this method from round wood or slabs without prior chipping makes the method unique when compared to other methods of producing coarse fiber pulps. Since no process water is required, an important advantage of the Defiberizer is that it can be installed in a small plant at the source of wood or woods waste and the product can be baled immediately and shipped to a converting mill. If cheap power is available, a low-cost fiber can be produced by this method at a rate of about 1 ton per hour per machine.

The Defiberizer converts low-grade wood into a form which offers possibilities for the development of a number of products such as a filler for sandwich board construction, the manufacture of Fibercrete (a combination of fiber with Portland cement), fiber plaster, and various kinds of fiberboard. Of a total production in 1946 of about 1,600,000 tons of high-grade, coarse-fiber pulp, it is estimated that only 50,000 to 60,000 tons (about 3 percent) were produced by Defiberizers.

The Defiberizer converts wood into fiber by mechanical means. Perhaps a more strict definition of the material produced would be shredded wood, rather than fiber. The individual shreds consist mostly of bundles of fibers and therefore do not have the same qualities as the refined fiber used in making paper. Were the defiberized wood more flexible, it might be used to a greater extent by the roofing manufacturers.

1/ See Lake States Aspen Report No. 2, "Aspen Availability and Supply," by Clarence D. Chase, Lake States Forest Experiment Station (St. Paul, Minnesota), June 1947.

The Defiberizer consists of a rigid steel frame into which are fitted two cylinders approximately 30 inches in length and 16 inches in diameter. To these cylinders numerous small sharp-pointed hammers are attached by rods extending along the axis of the cylinder. These hammers swing freely on the rods. The combination of the cylinders and the small hammers is called a brush. The sharp-pointed hammers are the bristles of the brush.

Above the brushes a hopper is mounted having an over-all length of 66 inches, divided into two compartments of 33 inches each. The hopper is 30 inches wide at the bottom with sides tapering to a top opening of 26 inches. The height of the hopper is 36 inches on the loading side and 48 inches high at the back. This hopper travels on four wheels 7 inches in diameter at a speed of 10 to 32 cycles per minute over the revolving brushes.

The bolts of wood to be made into fiber are not rossed; they are used in lengths of from 24 to 30 inches and are placed in the hopper in such a position that the fiber is removed from the tangential surface of the bolt. The action of the revolving brushes on the moving bolt produces the fiber. The resulting fiber can be sold as such or can be refined in an attrition mill to any degree of fineness desired.

The fact that this process provides a profitable means of utilizing wood of relatively low quality is of great importance. Many fire-scarred, insect or fungus-damaged pieces are usable. Poor-quality wood that naturally develops in any aspen operation and wood that has grown on sites of poor quality are usable. However, experience has shown that when knots are abundant the cost of machine maintenance is increased.

The aspen fiber made by this process heretofore has been mostly from round wood. However, the manufacture of fiber from slabs and edgings by this process offers possibilities. One mill on the West Coast now is using slabs. The hopper of the machine would have to be redesigned to take care of slabs and edgings instead of bolts. Narrower and shorter compartments might be necessary to keep the slabs and edgings in the proper position but the slabs and edgings could be fed into the hopper in exactly the same manner as the bolts, and the final product should be the same.

The yield from a standard cord of slabs and edgings would not be as high as from a cord of logs, and the expense of handling would be greater. However, slabs and edgings are waste material and must be disposed of in some way, and this costs money. If they can be converted into fiber from which even a small profit can be realized, it is better than to dispose of them as domestic fuel and to bother with many small accounts.

Coarse Grinding

In this process, pulpwood is ground in an ordinary pulpwood grinder fitted with a coarse-grit stone dressed with a much rougher grinding surface than is employed in the production of paper pulp.

Processes Involving Chipping and Fiberizing

In the processes described above, the wood to be reduced to fiber was used in bolt form. A number of processes are possible where the wood is reduced to chips, using an ordinary paper mill chipper for the purpose. The chips are given a simple treatment before being reduced to fiber. The treatment given the chips may be one of the following:

a. Soaking in water.

b. Steaming.

c. Semichemical cooking to varying degrees of intensity using a variety of chemicals.

Some of the methods by which the wood is used in the form of chips are as follows:

The Asplund Defibrator.--Unlike the fiberizing process previously described, the material fed into the Asplund Defibrator is first reduced to chips in a standard pulpmill chipper. The chips, with or without pulping chemicals, under steam pressure at a temperature of 175° to 200° C., are forced by a plunger or a screw feed mechanism against revolving refining disks which reduce the solid pieces of wood to a fibrous mass.

The Pandia Fibrilator.--This machine treats wood with steam by a continuous process similar to the Asplund Defibrator. It is sold without the attrition mill and may therefore be used in conjunction with any milling machine. In this case, however, the milling is not conducted under elevated steam pressures and temperatures.

The Masonite Process.--This consists of heating chips with high-pressure steam and then blowing them from the retort. The chips are "exploded" by the sudden release of pressure and are fiberized further by impact against a target.

Milling of Treated Chips.--After the chips have been treated by one of the above methods, one of the following mills can be used to reduce them to fiber:

a. Interplane Grinder
b. Bauer Mill
c. Jordan Engine
d. Rod Mill
e. Beater

If the fiber is to be used at once in the manufacture of some product, nothing further need be done. If the fiber is to be shipped, it must be converted to a damp or dry condition and baled.

Fiber Quality

In defiberized material it is necessary to keep in mind that we are dealing with a material of low strength but still strong enough to be made into such products as wallboards and felts. Since we are considering fiber with low strength values and a rather narrow field of utilization, the raw material must be abundant and cheap and the fiber must be produced at low cost.

When producing low-cost and low-strength fiber, two desirable qualities are penetrability and flexibility. If these qualities can be obtained, more of this kind of fiber could be used in certain products and additional uses might be developed.

Previously it was stated that fiber might be sold directly from the defiberizer and could be refined in an attrition mill. This refining process reduces the size of the individual shreds and to that extent makes them more flexible than the coarser shreds; however, it does nothing to the fiber itself to improve its flexibility.

At present it appears that converting wood into chips, then giving it some sort of treatment, and finally reducing it to fiber in an attrition mill will become an acceptable method of producing this kind of low-cost fiber.

It should be thoroughly understood that the manufacture of this class of fiber is at present in a state of flux. No one knows the best way to handle the various kinds of woody material that naturally find their way into this type of product. Considerable more research is needed in the next few years. When improved methods have been worked out, an important advance in better utilization of mill waste and low-grade aspen will have been made.